Original Article

NEURAL MOBILIZATION A THERAPEUTIC EFFICACY IN A PIRIFORMIS SYNDROME MODEL:AN EXPERIMENTAL STUDY

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ABSTRACT

Piriformis syndrome is a neuromuscular disorder that occurs when the sciatic nerve is compressed or otherwise irritated by the piriformis muscle causing pain, tingling and numbness in the buttocks and along the sciatic nerve. Traditional exercise therapy program for sciatica primarily focuses on pain relief but, neural mobilization should be viewed as another form of manual therapy similar to joint mobilization. The focus of this study is to see the effectiveness of neural mobilization on individuals with Piriformis syndrome and to assess the effectiveness over the conventional physical therapy treatment. The sample consisted of 42 subjects, from both sexes, ranging from 30 to 50-years-old. Parameters used are the Visual Analogue Scale (VAS) and Goniometry measurement for diagnosis and prognosis of the condition. An experimental design was used in this study. The initial 21 participants were assigned to a group I; receive Neural Mobilization and conventional physical therapy; while a second group of 21 participants were assigned as Group II to receive only conventional physical therapy. The median (IQR) of VAS pain in Experiment group is 0(0-0) whereas it is 1(0-1) in the Control group. The Median (IQR) of ROM hip for the Experimental group is 40(39-45) whereas it is 35(32-38 for the Control group. Hence, VAS pain score and ROM hip score depicted statistically significant difference ($p<0.001$) in the average range of VAS pain score and ROM hip score in Experimental group (treated with neural mobilization and conventional physical therapy treatment) than control group (treated with conventional physical therapy treatment alone. In this study it is concluded that there is a significant difference with in the Experimental group (neural mobilization and conventional physical therapy treatment) Setting-1(initial treatment) and setting 3(final treatment).

KEYWORDS: Physiotherapy, Neural mobilization, Piriformis Syndrome, Treatment for Piriformis syndrome.

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INTRODUCTION

Piriformis syndrome is a neuromuscular disorder that occurs when the sciatic nerve is compressed or otherwise irritated by the piriformis muscle causing pain, tingling and numbness in the buttocks and along the sciatic nerve. Pain in the buttock that radiates down the leg is commonly called sciatica. One possible cause of sciatica is piriformis syndrome. Piriformis syndrome can be painful, but it is seldom dangerous and rarely leads to the need for surgery. Most people with this condition can reduce the pain and manage the problem with simple methods, such as physical therapy[1]. This nerve runs behind the piriformis muscle in most people. The nerve actually splits through the piriformis muscle in about 20% of the population. When the piriformis becomes tight it can put pressure on the sciatic nerve causing irritation and sending pain down the back of theleg

(sciatica)[2]. Prevalence of sciatic symptoms did not differ between males and females[3]. It was 5.1% for men and 3.7% for women aged 30 years or over[4]. It is occupation related also.[5]

Neural mobilization (NM) is a part of manual therapy that has been reported to be an effective intervention for certain conditions[6,7] including carpal tunnel syndrome[8] and low back pain. Other investigators, however, have reported that NM provides no additional benefits when compared to other intervetions [9,10]. Mechanisms of NM have been primarily supported by theoretical concept[8].NM has been demonstrated to produce mechanical effects in terms of nerve strain and excursion in cadaveric studies[12, 13] and recent in vivo studies. Although limited in the literature, another potential effect of NM is on autonomic function. There are different methods of delivering NM, including "sliding" and "tensioning" techniques[10, 14, 15]. Sliding techniques involve combinations of movements that result in elongation of the nerve bed at one joint, while reducing the length of the nerve bed at an adjacent joint[12,16]. These techniques are suggested to be less aggressive in nature compared to tensioning techniques, which involve increasing the distance between each end of the nerve bed via elongation[15]. It has been demonstrated that these techniques exert different biomechanical effects on the nervous system[12,13]. For example, in a cadaveric study sliding techniques resulted in less strain and larger longitudinal excursion of the median nerve at the wrist when compared to tensioning techniques. Differences in clinical theories also exist when comparing these NM techniques. For example, sliding techniques have been theorized to play a role in the dispersion of inflammatory products and limiting fibroblastic activity.[13]

Moreover, tensioning techniques have been suggested to play a role in reducing intraneural swelling and circulatory stasis by altering intraneural pressure associated with this techniques.[13] Specific to the purposes of the current study, the hypoalgesic effects of NM utilizing tensioning techniques have not been reported as they have been for spinal manipulative therapy[17,18,19]. Traditional exercise therapy program for sciatica primarily focuses on pain relief[20] but, neural mobilization should be viewed as another form of manual therapy similar to joint mobilization. In order to pay heed to it manual methods should be used in order to restore the mechanical function of impaired neural tissue (intra-and extra neural impairment) in the lumbar-pelvic lower limb complex[21]. The focus of this study is to see the effectiveness of neural mobilization on individuals with Piriformis syndrome and to assess the effectiveness over the conventional physical therapy treatment.

MATERIALS AND METHODS

Participants

The sample consisted of 42 subjects, from both sexes, ranging from 30 to 50-years-old. Subjects with low back ache and buttock pain, registered in the physical therapy department were taken and a Differential diagnosis with other back conditions resembling Piriformis syndrome was established. If the subjects were found to have Piriformis syndrome, all inclusion and exclusion criteria (Presence of abnormality in congenital structures or acquired in the column, Disc pathology and Facet joint pathology, serious orthopedic diseases, mental incapacity, any infectious disease, and neoplasia) were checked. Out of the 42 subjects, 18 were males and 24 were female, of these 27 had symptoms on right side and 15 had on left side. The subjects were explained all about intervention and procedural details to be carried out in the study and thereafter consent was obtained. This study was conducted in Physiotherapy out-patient department of Co-Operative Institute of Health sciences & Co-Operative Hospitals, Thalassery, Kerala, India.

Procedures

Prior to the study the participants consent form is been filled and the wiliness of the subject towards the study is acquired. Following that Participants of this study were given a demographic profoma and filled. The Visual analogue scale (VAS) was described in order to decrease the basis level. VAS scale is a 10cm horizontal scale with two end points, one labeled no pain and other as worst pain. Subject is asked to place a mark which corresponds to the level of pain intensity the subject presently feels. The distance in centimeters from the lower end of Visual Analogue Scale to the subject mark is used

as numerical index of severity of pain. Follow up visit ask subject to rate their pain to determine the response to treatment. To collect the data regarding the Range of motion (ROM), Goniometer instruments were used.

Study Design

An experimental design was used in this study. The initial 21 participants were assigned to a group I; receive Neural Mobilization and conventional physical therapy; while a second group of 21 participants were assigned as Group II to receive only conventional physical therapy. All participants were blinded to their group assignment, while the investigator was aware of participant group assignment. Participants received intervention 2 to 3 times per week until they completed 10 sessions.

Interventions

Before starting the intervention all the patients were assessed for piriformis syndrome and pain free range of motion of Straight Leg Raise at the hip with the help of standard goniometer and Visual Analogue Scale respectively on affected side. Group I (Experimental Group) received neural mobilization was given for approximately 12-15 minutes per session including 30 sec hold and 1 min rest. The straight leg raise was done for inducing longitudinal tension (traction) as the sciatic nerve runs posterior to hip and knee joints while maintaining extension at the knee.

In order induce dural motion through the sciatic nerve; the leg was raised past 35 degrees in order to take up slack in the nerve. Since the sciatic nerve is completely stretched at 70 degrees, pain beyond that point is usually of hip, sacroiliac, or lumbar spine origin[22]. The unilateral straight leg raise causes traction on the sciatic nerve, lumbo sacral nerve roots, and dura mater. Adverse neural tension produces symptoms from the Piriformis muscle (buttocks area) extending into the sciatic nerve distribution of the affected lower limb. To introduce additional traction (i.e., sensitization) into the proximal aspect of the sciatic nerve, hip adduction was added to the straight leg raise. The average total treatment time was approximately 35-45 minutes per session and the whole treatment was given for maximum of 10 sessions, along neural mobilization conventional physical therapy treatment was also administered .Pain free Range of motion at hip (Internal rotation) and Visual Analogue Scale was recorded at the baseline and at the end of final treatment sessions. The control groups (Group II) were only limited to conventional physical therapy treatment which included Ultrasound therapy with an Intensity of 2.25 – 2.5 watts /cm2 for Duration of 10 – 15 mins and a High TENS for 10 mins. The patients were instructed not to do any type of exercise at home or take any medications.

Statistical analysis

Data were anonymously coded and entered into Microsoft EXCEL sheet and exported to STATA 12.0; using the software cleaned and analyzed. Descriptive analysis was performed: for the categorical variables percentages and frequencies were used and for the continuous not normally distributed variables median and inter-quartile range (IQR) were used for the summarization. The continuous variables normality was checked using box plot graphs. Because the data were not normally distributed; to compare the age, weight, ROM and pain on VAS two-sample Wilcoxon rank-sum (Mann-Whitney) test was used, Wilcoxon signed rank sum test were also used for the analysis to compare improvement on Baseline and at the 10th sessions within the two groups. To compare categorical variable with the outcome chi-square test was used. Data findings were considered statistically significant when revealing a p-value of 0.05 or less.

RESULTS AND TABLES

Table 1: Baseline Demographic and clinical characteristics of the respondents

Variables	Experimental group	Control group	p-value
Sex			
Female	13(41.9)	18(58.1)	0.196
Male	17(58.6)	12(41.4)	
Age			
Median(IQR)	34.5(31-43)	36.5(31-41)	0.881
Weight			
Median(IQR)	62.5(57-67)	61.5(57-67)	0.834
VAS pain			
Median(IQR)	9(8-10)	9(8-10)	0.921
ROM hip			
Median(IQR)	15(10-22)	20(14-25)	0.167

From all the respondents data were collected, and this made 100% response rate. There were no statistically significant differences with baseline demographic and clinical characteristics

in both group respondents. The median age (IQR) of the respondents in the Experimental group (Group I) is 34.5(31-43) whereas, the Median age (IQR) of the respondents in the control group (Group II) is 36.5(31-41). The intensity of VAS pain in both Experimental and control group is the same Median (IQR) 9(8-10) (Table 1).

Table 2: Inter group comparison of all the outcome measures in both the groups after sitting-1 (initial treatment session).

	Sitting-1 (After initial Treatment session)			
Variables	Group I	Group II	z-value	p-value
VAS pain				
Median(IQR)	5(5-6)	5(4-6)	0.97	0.332
ROM hip				
Median(IQR)	26.5(22-30)	25(20-30)	0.996	0.319

There is no statistically significant difference in the Experimental and Control group of VAS pain and ROM hip. In the first treatment protocol-A (neural mobilization and conventional physical therapy treatment) for control Experimental group/group I and treatment protocol-B (conventional physical therapy treatment only) for control group /group II was given in treatment session -2 (Table 2) and Illustrated same in Figure I&II.

Fig. 1: Sitting-1 (Initial treatment session) VAS pain in group I&II.

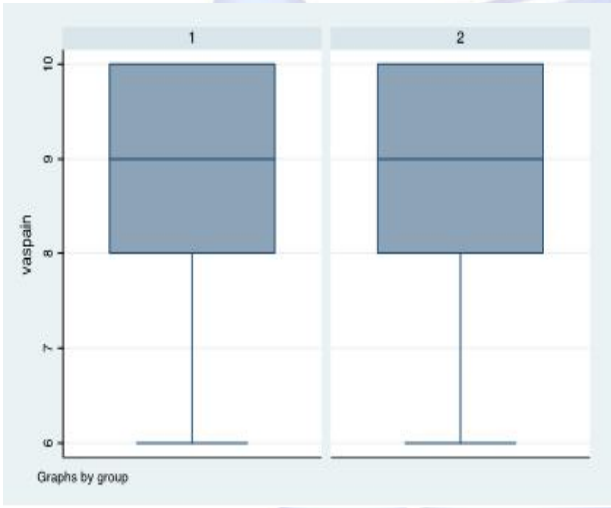

Fig. 2: Sitting-1 (Initial treatment session)ROM hip in group I&II.

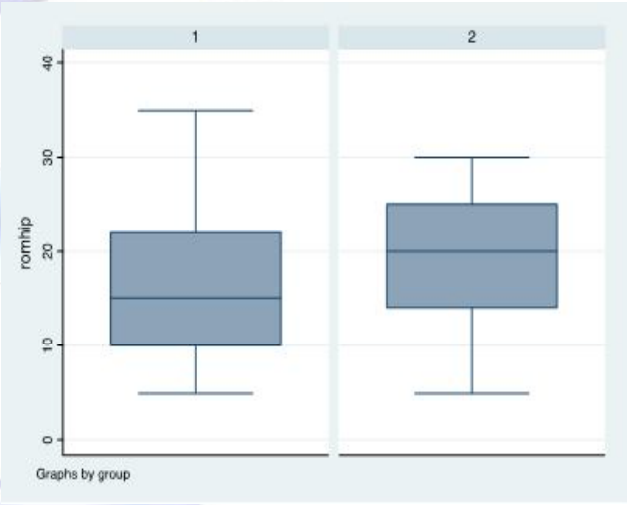

Table 3: Inter group comparison of all the outcome measures in both the groups in final treatment session.

	Sitting-3 (After Final treatment session)			
Variables	Group I	Group II	z-value	p-value
VAS pain				
Median(IQR)	0(0-0)	1(0-1)	3.815	0
ROM hip				
Median(IQR)	40(39-45)	35(32-38)	4.879	0

The median (IQR) of VAS pain in Experiment group is 0(0-0) whereas it is 1(0-1) in the Control group. The Median (IQR) of ROM hip for the Experimental group is 40(39-45), whereas it is 35(32-38 for the Control group). Hence, VAS pain score and ROM hip score depicted statistically significant difference ($p<0.001$) in the average range of VAS pain score and ROM hip score in Experimental group (treated with neural mobilization and conventional physical therapy treatment) than control group (treated with conventional physical therapy treatment alone) sitting 3(Final treatment session) (Table 3)

Table 4: Intra group comparison of all the outcome measures in both treatment sessions in group I.

	Group I			
Variables	Sitting1	Sitting 3	z-value	p-value
VAS pain				
Median(IQR)	9(8-10)	0(0-0)	4.816	0
ROM hip				
Median(IQR)	15(10-22)	40(39-45)	4.786	0

It is statistically significant that Treatment protocol A (neural mobilization and conventional physical therapy treatment) for the Experimental group brought a decrease in the intensity of pain at the end of the final treatment session with VAS pain Median (IQR) in 1st sitting (initial treatment session) 9(8-10) and Sitting 3 (final treatment session) 0(0-0) with P-value of (0.001) (Table-4).

Whereas The Median (IQR) of ROM hip in 1st Sitting (initial treatment session) was 15(10-22) and in after the final treatment, it was (40(39-

45) with P-value of (0.001). So, it is concluded that there is a significant difference with in the Experimental group Sitting 1(initial treatment) and sitting 3(final treatment) and also illustrated in figure III&IV.

Fig. 3: Sitting 3 VAS pain in group I&II.

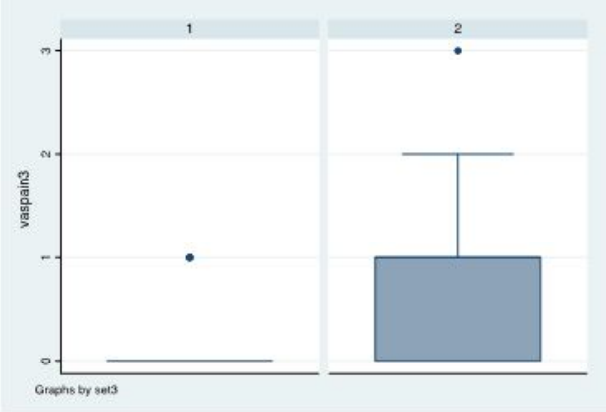

Fig. 4: Sitting 3 ROM hip in group I&II.

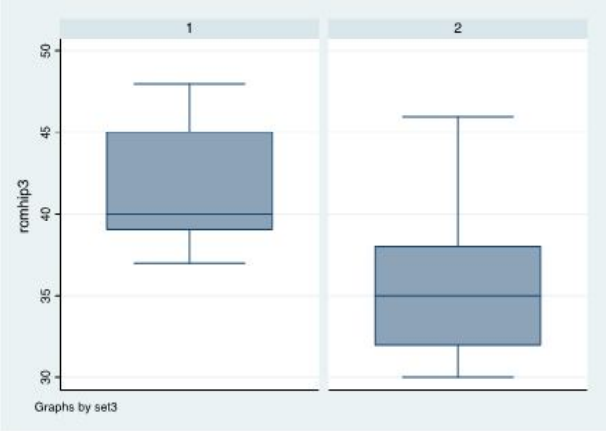

Table 5: Intra group comparison of all the outcome measures in both treatment sessions in group II.

	Group II			
Variables	**Sitting-1**	**Sitting-3**	**z-value**	**p-value**
VAS pain				
Median(IQR)	9(8-10)	1(0-1)	4.827	0
ROM hip				
Median(IQR)	20(14-25)	35(32-38)	4.787	0

It was statistically significant that Treatment B (conventional physiotherapy) brought a decrease in the intensity of pain at sitting 3 (end of the treatment session) with VAS pain Median (IQR) in sitting-1 was 9(8-10) and setting-3 was 1(0-1) with P-value of (0.001).

Whereas the Median (IQR) of ROM hip in sitting-1 was 20(14-25) and in sitting-3 (after final treatment) it was 35(32-38) with P-value of (0.001). So, it was concluded that there is a significant difference with in the Experimental group (neural mobilization and conventional physical therapy treatment) Sitting-1(initial treatment) and sitting-3(final treatment). (Table-5)

DISCUSSION

In the current study the median (IQR) of VAS pain in Experiment group A was 0(0-0) whereas it was 1(0-1) in the Control group B. The Median (IQR) of ROM hip for the Experimental group A was 40(39-45) with the P-value of (0.001) whereas it was 35(32-38 for the Control group B with the P-value of (0.001). So, VAS pain score and ROM hip score depicted statistically significant difference ($p<0.001$) in the average range of VAS pain score and ROM hip score in the study group. Participants treated with neural mobilization and conventional physical therapy treatment for the Experimental group A were more significant than Control group B (conventional physical therapy treatment alone. This result was in line with a study conducted in Ambala, India which states that at the end of 6th session the mean±SD of VAS of group A was 3.47±0.99 and that of group B was 5.53±1.13 and the t value was found to be 5.34 which was significant. Similarly at the end of 6th session the mean±SD of VAS of group A was 1.67±0.98 and that of group B was 4.60±1.12 and the t value was found to be 7.64 which were significant[23]. Thus ROM hip and VAS pain showed significant results only by the end of 6th and final treatment sessions.

It is statistically significant that Treatment (neural mobilization and conventional physical therapy treatment for the Experimental group) brought a decrease in the intensity of pain at the end of the treatment session with VAS pain Median (IQR) in setting one 9(8-10) and setting three 0(0-0) with P-value of (0.001). Whereas The Median (IQR) of ROM hip in setting one was 15(10-22) and in setting three (after the final treatment) it was (40(39-45) with P-value of (0.001). So, it is concluded that there is a significant difference with in the Experimental group Setting 1(initial treatment) and setting-3 (final treatment) similarly in Control group It is statistically significant that Treatment B (conventional physiotherapy) brought a decrease in the intensity of pain at the end of the treatment session with VAS pain Median (IQR) in setting one 9(8-10) and setting three

1(0-1) with P-value of (0.001). Whereas The Median (IQR) of ROM hip in setting one was 20(14-25) and in setting-3 (after final treatment) it was 35(32-38) with P-value of (0.001). So, it is concluded that there is a significant difference with in the Experimental group (neural mobilization and conventional physical therapy treatment) Setting-1(initial treatment) and setting 3(final treatment. This result is identical with a study conducted in Ambala, India which states treatment between 3rd and 6th session the mean difference of group A was 18.00±2.50 whereas that of group B was 9.33±4.58 and the t values were 5.28 and 4.47 respectively. [23]

CONCLUSION

In conclusion both the treatments neural mobilization and conventional physical therapy treatment brings better significant difference in the treatment of Experimental group subjects than conventional physical therapy treatment alone in control group in terms of the Median(IQR) score and the intensity of VAS pain and hip ROM. The intensity of VAS pain in Experimental group is minimal compare to the control group at the end of treatment sessions. In addition to the hip ROM pain free ROM in the Experimental group is increased when compare to the control group. Even though, conventional physical therapy treatment alone has a significant difference, it brings more significant difference if it is given in a combination of neural mobilization and conventional physical therapy treatment.

List of abbreviations

1. IQR – inter quartile range
2. NM – Neural Mobilization
3. SD – Standard Deviation
4. ROM – Range of Motion
5. VAS – Visual Analogue Scale

Recommendations

1. It is highly recommended that neural mobilization technique along with conventional physiotherapy improves Hip range of motion which makes and decrease pain ,its an effective management of piriformis syndrome.

2. It is also recommended that a similar study can be conducted for sports persons with different age groups and can compare the different kinds of other physiotherapy treatments for piriformis syndrome.

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Conflicts of interest: None

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